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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/586,660

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Koji Kotani

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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/586,660	Applicant(s) KOTANI, KOJI	
	Examiner RAKESH K. DHINGRA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 July 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>0706.09/06.12/06</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

1) Figure 7 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2) The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

Figure 7 – Reference numbers 204, 200A, 808a and 808b are not shown in the drawing (specification – page 2, line 10 and page 2, lines 27, 28).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

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3) The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description:

Figure 7 – Reference numbers 308a, 308b are not described in the specification.

Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3, 4, 8-12, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Kitagawa (US 2001/0024114).

Regarding Claims 1, 10, 12: Admitted prior art teaches a plasma apparatus comprising:

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A processing container 100 having a holding stage 103 that holds a substrate 102 to be processed;

a micro-wave transmission window (shown in Fig. 7) provided on or above the processing container, opposite to the substrate to be processed placed on the holding stage;

a micro-wave antenna 200 provided on or above the micro-wave transmission window, opposite to the micro-wave transmission window, for supplying a micro-wave into the processing container;

a micro-wave electric power supplying source 302 connected to the micro-wave antenna 200;

an electric-field measuring unit 308a, 308b that measures electric field strength of the micro-wave; and

a controlling unit 500A that controls the micro-wave electric power supplying source based on the electric field strength measured by the electric-field measuring unit 308A, 308B (e.g. Figure 7 and page 1, line 35 to col. 3, line 14).

Admitted prior art does not teach the electric-field measuring unit measures electric field strength of the micro-wave supplied by the micro-wave antenna; and wherein the electric-field measuring unit is arranged at a loop of a standing wave formed in the micro-wave transmission window.

Kitagawa teaches a plasma apparatus comprising:

a processing container 4 having a holding stage (not shown in Figures 1, 2) that holds a substrate to be processed;

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a micro-wave transmission window 3 provided on or above the processing container, opposite to the substrate to be processed placed on the holding stage;

a micro-wave antenna 2 provided on or above the micro-wave transmission window 3, opposite to the micro-wave transmission window, for supplying a micro-wave into the processing container;

a micro-wave electric power supplying source (e.g. microwave oscillator 607 in Fig. 6) connected to the micro-wave antenna (and the waveguide);

a plurality of electric-field measuring units 5 that measures electric field strength of the micro-wave supplied by the micro-wave antenna 2; and

a controlling unit (e.g. control unit 611 in Fig. 6) that controls the micro-wave electric power supplying source based on the electric field strength measured by the electric-field measuring unit 5. Kitagawa does not explicitly teach the electric-field measuring unit is arranged at a loop of a standing wave formed in the micro-wave transmission window 3, but teach that voltage is measured by probes 5 located along circumferential and radial directions of the microwave window 3 (Fig. 5). It would be obvious to locate the electric field measuring unit at a loop of the standing wave to enable measure the electric field strength (e.g. Figs. 1-4 and para. 0025-0031).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide an electric field measuring unit that measures electric field strength of the micro-wave supplied by the micro-wave antenna and is arranged at a loop of a standing wave formed in the microwave transmission window as taught by Kitagawa in the apparatus of

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admitted prior art to enable control the supply of activated gas to the process chamber or to bypass line by using a single valve.

Regarding Claim 3: Kitagawa teaches the antenna 2 is a radial line slot antenna (Fig. 2, 5).

Regarding Claims 4, 8: Kitagawa teaches the electric field measuring unit 5 is an antenna (field measuring probe) and is adapted to measure voltage.

Regarding Claim 9: Kitagawa teaches the electric field measuring unit 5 attached to dielectric window 3 which is attached to slot antenna 2.

Regarding Claim 11: Kitagawa teach plurality of electric field measuring units 5 are arranged in circumferential and radial directions (linear direction) [para. 0030].

Regarding claim 15: Kitagawa teaches that the control unit (611) compares distribution of signal intensities through plural electric field measuring units 5 with simulation results and and adjust electric field strength accordingly (para. 0041).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Kitagawa (US 2001/0024114) as applied to claims 1, 3, 4, 8-12, 15 and further in view of Murakawa et al (US 6,388,632).

Regarding Claim 2: Admitted prior art in view of Kitagawa teach all limitations of the claim including that the micro-wave antenna 200 is fed via coaxial waveguides 301.

Admitted prior art in view of Kitagawa does not teach the micro-wave antenna has: an antenna main body having an opening; a micro-wave radiation surface provided on or above the antenna main body so as to cover the opening, the micro-wave radiation surface having a

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plurality of slots; and a dielectric plate provided between the antenna main body and the micro-wave radiation surface.

However use of a radial line slot antenna with the claimed structure is known in the art for uniformly supplying microwaves into plasma chamber.

Murakawa et al teach a plasma apparatus comprising a radial line slot antenna A1 having an antenna main body 2 having an opening 4; a micro-wave radiation surface 7 provided in the antenna main body so as to cover the opening 4, the micro-wave radiation surface 7 having a plurality of slots 8; and a dielectric plate 6 provided between the antenna main body 2 and the micro-wave radiation surface 7 (e.g. Figs. 1, 2 and col. 4, lines 40-65).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a slot antenna with the configuration as taught by Murakawa et al in the apparatus of admitted prior art in view of Kitagawa for uniformly supplying microwaves into plasma chamber

Claims 5, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Kitagawa (US 2001/0024114) as applied to claims 1, 3, 4, 8-12, 15 and further in view of Hajime et al (JP 11-044720).

Regarding Claim 5: Admitted prior art in view of Kitagawa teach all limitations of the claim except the electric field measuring probe has a structure in which a threaded portion and a measurement terminal that consist of an electric conductor are inserted into an outside container having a substantially cylindrical shape and made of an electric insulator, and in which the

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threaded portion and the measurement terminal are electrically connected by a semiconductor material.

Hajime et al teach an electric field sensor comprising conductive measuring terminals 101a, 10b are joined by screws 205 and inserted into a outside container 203 made from dielectric (insulator) and also electrically connected with a semiconductor material (diode) 202. Hajime et al also teach that container 203 can have different shapes having symmetry (which could also include cylindrical shape) [e.g. Figs 1-5 and para. 0020-0032]. Further, it would be obvious to use known alternate joining methods like the probe having a threaded portion joined to the container having internal threads.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electric field measuring probe with the structure as taught by Hijme et al in the apparatus of admitted prior art in view of Kitagawa to obtain a sensor that provides accurate measurement of electric field intensity.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Kitagawa (US 2001/0024114) as applied to claims 1, 3, 4, 8-12, 15 and further in view of Buck (US 6,239,587).

Regarding Claim 7: Admitted prior art in view of Kitagawa teach all limitations of the claim except the electric field measuring probe has an opening for in-filling of an insulation material.

Buck teaches a RF voltage measurement probe comprising a container 12 with a cavity 17. Buck further teach the container has opening at its end through which an insulation material

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(Teflon) is filled inside the container which helps to match the impedance with the incoming transmission line and enables to obtain accurate measurements (e.g. Fig. 1A and col. 2, lines 15-41).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the outside container of the electric field measuring probe with an opening for infilling of an insulation material as taught by Buck in the apparatus of admitted prior art in view of Kitagawa to match the probe impedance with the transmission line and obtain accurate measurements.

Claims 13, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Kitagawa (US 2001/0024114) as applied to claims 1, 3, 4, 8-12, 15 and further in view of Harris (US 6,075,422).

Regarding Claims 13, 14: Admitted prior art in view of Kitagawa teach all limitations of the claim except that when a wavelength of the standing wave formed in the microwave transmission window is expressed as λ , a distance between the plurality of electric-field measuring units is $\lambda/4$ multiplied by an odd number.

Harris teaches a microwave plasma apparatus in which a plurality of movable probes 30, 31 are provided that enable to provide control over electromagnetic power being transferred to the load. Harris further teach that distance between the two probes is related to the wavelength of the microwaves to obtain impedance matching with the load (e.g. Fig. 1 and col. 4, line 43 to col. 5, line 10). Further it is known in the art that in standing waves the successive nodes and antinodes are spaced $\lambda/2$ distance apart. It would be obvious to optimize the spacing between the plurality of electric field measuring probes as per teaching of Harris and Kitagawa

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to obtain data regarding pattern of loops and nodes in the standing waves of the electric field in the dielectric window.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the spacing between the plurality of electric field measuring probes as per teaching of Harris in the apparatus of admitted prior art in view of Kitagawa to enable obtain data regarding pattern of loops and nodes in the standing waves of the electric field in the dielectric window.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Rakesh K Dhingra/

Examiner, Art Unit 1792

/K. M./

Primary Examiner, Art Unit 1792